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(54) Top-entry rod retainer

Von oben zugänglicher Stabhalter

Dispositif de fixation d'une tige à insérer par le haut

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(73) Proprietor: **ACROMED CORPORATION**
Cleveland Ohio 44115 (US)

(72) Inventors:
- **Stahurski, Terrence M.**
  Rocky River, Ohio 44116 (US)
- **Helnig, Charles F.**
  Ware Neck, Virginia 23178 (US)
- **Carson, William L.**
  Columbia, Missouri 65203 (US)
- **Janson, Frank S.**
  Rocky River, Ohio 44116 (US)
- **Strippgen, Walter E.**
  Golden, Colorado 80403 (US)
- **Gaines, Robert W., Jr.**
  Columbia, Missouri 65203 (US)
- **Asher, Marc A.**
  Leawood, Kansas 66211 (US)

(74) Representative: **Rottmann, Maximilian R.**
c/o Rottmann, Zimmermann + Partner AG
Glattalstrasse 37
8052 Zürich (CH)

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EP 0 535 623 B1

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Description

Background of the Invention

The present invention relates to an implant which engages a spinal column to hold a longitudinal member or rod in position relative to the spinal column.

Spinal implants have been used in treatment of patients with deformed and/or mechanically insufficient spinal columns. Longitudinal members or rods have been contoured to a desired configuration and connected with a spinal column. Among the various devices used to connect a rod with a spinal column have been hooks having through openings which receive the rod. While the hook is loose on the rod, a blade or free end of the hook is moved into engagement with the spinal column. Once the hook has been positioned relative to the spinal column, a set screw or clamp member is tightened to securely interconnect the hook and the rod.

In the past, difficulties have been encountered in positioning the hook and rod relative to the spinal column. If the hook is placed on the rod before being connected with the spinal column, the rod tends to interfere with placement of the hook relative to the spinal column. If the hook is connected with the spinal column before being positioned on the rod, difficulty may be encountered in moving the rod through an opening in the hook without disturbing the placement of the hook relative to the spinal column.

The concept of providing a top-entry opening in a hook to receive a rod without sliding the hook along the rod is disclosed in U.S. Patent No. 4,269,178 issued May 26, 1981 and entitled "Hook Assembly For Engaging A Spinal Column". This patent teaches that the hook is to be held in place by the use of a sleeve and a locking nut. The locking nut engages external threads on the rod and must be threaded along the rod to a position where the hook is to be located. In addition, the sleeve must be positioned on the rod adjacent to the locking nut.

EP-A-0 330 881 discloses an apparatus according to the preamble of claim 1.

Summary of the Invention

The present invention provides an apparatus for use in retaining a longitudinally extending member in position relative to a spinal column, as defined in claim 1.

Brief Description of the Drawings

The invention will become more apparent upon a consideration of the following description taken in connection with the accompanying drawings.

Spinal implants not in accordance with the present invention are described merely for illustration purposes.

Fig. 1 is an exploded illustration of a top-entry hook assembly not in accordance with the present invention;

Fig. 2 is a pictorial illustration depicting the manner in which a hook portion of the top-entry hook assembly of Fig. 1 is positioned relative to a spinal column, an end cap of the hook assembly having been removed;

Fig. 3 is an illustration, generally similar to Fig. 2, depicting the manner in which a longitudinal member or rod is placed in a recess in the hook portion after the hook portion has been positioned relative to the spinal column;

Fig. 4 is an illustration, generally similar to Fig. 3, of the top entry hook assembly with the end cap in place;

Fig. 5 is a front elevational view of the hook portion of the top-entry hook assembly of Fig. 1 and illustrating the relationship between a pair of connector flanges and an open ended recess in a body portion of the hook assembly;

Fig. 6 is a side elevational view, taken generally along the line 6-6 of Fig. 5, further illustrating the construction of the hook portion;

Fig. 7 is a top plan view, taken generally along the line 7-7 of Fig. 5, illustrating the configuration of a side opening through which a longitudinal member or rod is inserted into a recess in the body portion of the top-entry hook assembly;

Fig. 8 is a front elevational view, generally similar to Fig. 5, of a hook portion constructed in accordance with the present invention;

Fig. 9 is a side elevational view, taken generally along the line 12-12 of Fig. 8, further illustrating the construction of a hook portion of the top-entry assembly;

Fig. 10 is a front elevational view of an end cap which is connected with the hook portion of Fig. 8 to close an opening in the upper side of a recess in the top-entry hook assembly; and

Fig. 11 is a side elevational view, taken generally along the line 14-14 of Fig. 10, further illustrating the construction of the end cap.

General Description

A top-entry hook assembly 20 not in accordance with the present invention is illustrated in Fig. 1. The top-entry hook assembly 20 includes a one-piece, metal, hook portion 22 and a metal end cap 24. The hook portion 22 includes a generally rectangular body 26 and a downwardly extending hook 28.

The body 26 of the hook portion 22 has an open ended recess 32 which extends through the body and is open at opposite ends of the body to receive a rod or longitudinal member. The hook 28 includes a shank portion 34 and free end or blade portion 36 which are engageable with an element of a spinal column to interconnect the spinal column and a rod extending through the open ended recess 32.

The recess 32 has a first larger radius R1 (Fig. 5) and a second smaller radius R2. The radius R2 forms a pair of axially spaced arcuate surfaces 130 (Fig. 7). The pair of axially spaced arcuate surfaces 130 engage portions of the rod at axially spaced locations. Reference is hereby made to U.S. Patent No. 5,024,213 to Asher et al. and assigned to the same assignee as the present invention. U.S. Patent No. 5,024,213 describes the arcuate surfaces and their function in greater detail.

The end cap 24 (Fig. 1) is removable from the hook portion 22. When the end cap 24 is removed from the hook portion 22, a rectangular upper side opening 40 to the recess 32 is exposed. A rod or other longitudinal member can be readily inserted through the upper side opening 40 into the recess 32.

The hook portion 22 may be mounted on a spinal column 44 by interlaminar placement of the hook 28 as shown in Fig. 2. However, the hook 28 could also have supralaminar, infratransverse or supratransverse placement relative to the spinal column 44 if desired.

Once the hook portion 22 of the hook assembly 20 has been connected with the spinal column 44 as shown in Fig. 2, a rod or longitudinal member 48 may be placed in the recess 32 (Fig. 3). The cylindrical rod 48 is placed in the recess 32 by moving the rod downwardly through the open upper side 40 of the recess. When the rod 48 has been positioned in the recess 32, the rod extends through generally U-shaped end openings 52 and 54 (Figs. 1 and 3) disposed at opposite sides of the body 26. When the rod 48 is placed in the recess 32, a longitudinal central axis 58 of the rod extends generally parallel to the free end or blade portion 36 of the hook 28. The rod 48 is shown in Figs. 3 and 4 as straight but would normally be curved to a desired configuration. If desired, devices other than the hook 28 may be used to connect the body 26 with the spinal column 44.

Once the rod 48 has been placed in the open ended recess 32, the end cap 24 is connected with the hook portion 22 (Fig. 4). The end cap 24 blocks the upper side opening 40 of the recess 22 while enabling the rod 48 to extend through the end openings 52 and 54 (Fig. 3) of the recess 32. Once the end cap 24 has been connected with the hook portion 22 of the hook assembly 20, a clamp member or set screw 60 (Figs. 1 and 4) is tightened to interconnect the rod 48 and hook assembly. The recess 32 has a vertical dimension as viewed in Fig. 5 such that the rod 48 can be moved vertically in the recess prior to the set screw 60 being tightened.

The clamp member or set screw 60 is located at the center of the end cap 24. The set screw 60 has a vertical (as viewed in Fig. 1) central axis 62 which intersects the horizontal (as viewed in Fig. 4) longitudinal central axis 58 of the rod 48. The set screw 60 presses the rod 48 against the arcuate surfaces 130 to clamp the rod against movement relative to the hook assembly 20. In addition to pressing the rod 48 against the arcuate surfaces 130, the set screw 60 applies an upwardly directed force against the end cap 24 to retain the end cap against disengagement from the hook portion 22.

Since the end cap 24 is disengageable from the hook portion 22 of the hook assembly 20, the rod 48 can be readily inserted into the recess 32 through the upper side opening 40. This enables the rod 48 and hook assembly 20 to be positioned relative to each other without sliding the hook assembly along the rod or moving the rod axially through the hook assembly. By mounting the clamp member or set screw 60 in the end cap 24, it is not necessary to provide a clamp member which is separate from the hook assembly 20 and which must be positioned along the rod 48.

Hook Assembly - Linear Cam Connector

The invention is illustrated in Figs. 8-11, wherein the end cap and hook portion are interconnected by linear flange surfaces. Since the invention illustrated in Figs. 11-14 is generally similar to the spinal implants illustrated in Figs. 1-7, similar numerals will be utilized to designate similar components, the suffix letter "a" being associated with the numerals of Figs. 8-11 to avoid confusion.

The hook portion 22a of the invention has a pair of rectangular flanges 68a and 70a (Figs. 8 and 9). The flanges 68a and 70a extend parallel to each other and have a generally uniform cross section throughout their length. The flanges 68a and 70a are disposed at the upper end of a generally rectangular body 26a. A hook 28a is integrally formed with and extends downwardly from the body 26a and has a shank portion 34a and a free end or blade portion 36a.

An open ended recess 32a is formed in the body 26a of the hook portion 22a. The open ended recess 32a has an open upper side 40a, a generally U-shaped end opening 52a and a second end opening corresponding to the end opening 54 (Fig. 1) of the hook portion 22.

The end cap 24a (Figs. 10 and 11) has a pair of linear flanges 74a and 76a which extend downwardly from a base portion 122a of the end cap. The base portion 122a has a flat rectangular lower side surface 98a. The side surface 98a of the base 122a engages rectangular upper side surfaces 94a and 96a (Fig. 8) on the hook portion flanges 68a and 70a.

The lower side surface 98a of the end cap base 122a is skewed downwardly slightly. Therefore, the distance between the lower side surface 98a and rectangular upper side surfaces of the end cap flanges 74a and 76a decreases along the length of the linear flanges. When the end cap 24a is moved along a linear path onto the hook portion 22a, the upper side surface 98a forms a cam which presses against the upper side surfaces 94a and 96a (Fig. 8) of the hook portion flanges 68a and 70a to grip the hook portion flanges with the flanges 74a and 76a on the end cap 24a.

Once the end cap 24a has been positioned on the hook portion 22a, a clamp member or set screw 60a is rotated to apply force against the rod disposed in the open ended recess 32a to press the rod against the bot-

tom of the recess. In addition, the force applied against the rod by the set screw 60a results in the end cap flanges 74a and 76a being pulled upwardly against the hook portion flanges 68a and 70a to hold the end cap against movement relative to the hook portion 22a. The set screw 60a is disposed at the center of the end cap 24a.

The present invention is defined by the appended claims.

Claims

1. An apparatus for use in retaining a longitudinally extending member in position relative to a spinal column, said apparatus comprising a body (26a) having a recess (32a) which extends through the body (26a), said recess (32a) having a side opening (40a) a first end opening (52a) formed in a first end of the body (26a) and intersecting the side opening (40a) and a second end opening formed in a second end of the body (26a) opposite from the first end and intersecting the side opening (40a) to enable the longitudinally extending member to be moved into the recess (32a) through the side opening (40a) and to extend from the first and second ends of said body (26a) through the first (52a) and second end openings, said body (26a) including a connector element (28a) extending from said body (26a) opposite from the side opening (40a) and connectable with the spinal column to connect said body (26a) with the spinal column, an end cap (24a) movable between a disengaged position spaced from said body (26a) and an engaged position at least partially enclosing said body (26a) and extending across the side opening (40a) in said body (26a), connector means (98a, 99a, 82a, 96a, 80a, 94a) for releasably connecting said end cap (24a) with said body (26a) when said end cap (24a) is in the engaged position, and a clamp member (60a) mounted on said end cap, said clamp member (60a) being movable relative to said end cap (24a) when said end cap (24a) is in the engaged position to clamp a longitudinally extending member disposed in the recess (32a) against said body (26a),
characterized in that said connector means (90a, 99a, 82a, 96a, 80a, 94a) comprises a first surface (98a) on said end cap (24a) and a second surface (99a) on said end cap (24a), said first surface (98a) being disposed in a plane which extends at an acute angle to a central axis of said recess (32a), said surfaces (98a, 99a) being spaced apart a first distance at a first location on said end cap (24a) adjacent said first end of said body (26a) when said end cap (24a) is in the engaged position, said first and second surfaces (98a, 99a) on said end cap (24a) being spaced apart a second distance smaller than the first distance at a second location on said end cap (24a) adjacent said second end of said body (26a) when said end cap (24a) is in the engaged position, whereby said first and second surfaces (98a, 99a) extending at an acute angle to each other, said body (26a) having a pair of flanges (68a, 70a) with substantially parallel surfaces (82, 96a; 80a, 94a), said first surface (98a) being engageable with upper surfaces (94a, 96a) on said body (26a) and said second surface (92a) being engageable with said surfaces (80a, 82a) to grip said body (26a) prior to said clamp member (60a) clamping the longitudinally extending member in the recess (32a) against said body (26a).

2. An apparatus as set forth in claim 1, characterized in that said connector element (28a) is a hook which extends from said body (26a) opposite from the side opening (40a) and which is engageable with the spinal column, said hook (28a) having a shank portion (34a) connected with said body (26a) and a free end portion (36a) extending from said shank portion (34a) in the direction of a plane extending through the second end of said body (26a) to enable said hook (28a) to engage an element of the spinal column when the longitudinally extending member is disposed in the recess (32a).

3. An apparatus as set forth in claim 1, characterized in that said clamp member (60a) is a single set screw which is rotatable relative to said end cap (24a) to clamp the longitudinally extending member and said body (26a) together when the longitudinally extending member is in the recess (32a).

Patentansprüche

1. Vorrichtung zur Verwendung bei der Festlegung der Lage eines sich in Längsrichtung erstreckenden Elements relativ zu einer Wirbelsäule, wobei diese Vorrichtung einen Körper (26a) mit einem Ausschnitt (32a) umfasst, der sich durch den Körper (26a) hindurch erstreckt, wobei dieser Ausschnitt (32a) eine seitliche Öffnung (40a), eine erste endseitige Öffnung (52a), die in einem ersten Ende des Körpers (26a) ausgebildet ist sich mit der seitlichen Öffnung (40a) schneidet, und eine zweite endseitige Öffnung aufweist, die in einem zweiten Ende des Körpers (26a), gegenüber dem ersten Ende, ausgebildet ist sich mit der seitlichen Öffnung (40a) schneidet, um es dem sich in Längsrichtung erstreckenden Element zu ermöglichen, dass es durch die seitliche Öffnung (40a) in den Ausschnitt (32a) bewegt werden und sich von den ersten und zweiten Enden des genannten Körpers (26a) durch die ersten (52a) und zweiten, endseitigen Öffnungen erstrecken kann, wobei der genannte Körper (26a) umfasst:

   - ein Befestigungselement (28a), das sich gegenüber der seitlichen Öffnung (40a) vom

genannten Körper (26a) aus erstreckt und das an der Wirbelsäule befestigbar ist, um den genannten Körper (26a) an der Wirbelsäule zu befestigen,

- eine Abschlusskappe (24a), die bewegbar ist zwischen einer entkoppelten Position, in der sie im Abstand zum genannten Körper (26a) ist, und einer eingekoppelten Position, in der sie den genannten Körper (26a) zumindest teilweise umgreift und sich über die seitliche Öffnung (40a) im genannten Körper (26a) erstreckt,
- Befestigungsmittel (98a, 99a, 82a, 96a, 80a, 94a), um die genannte Abschlusskappe (24a) am genannten Körper (26a) lösbar zu befestigen, wenn die genannte Abschlusskappe (24a) in der eingekoppelten Position ist, und
- ein an der genannten Abschlusskappe angeordnetes Klemmorgan (60a), das gegenüber der genannten Abschlusskappe (24a) beweglich ist, wenn die genannte Abschlusskappe (24a) in der eingekoppelten Position ist, um ein sich in Längsrichtung erstreckendes, im Ausschnitt (32a) gelegenes Element gegen den genannten Körper (26a) zu klemmen,

dadurch gekennzeichnet,

- dass die genannten Befestigungsmittel (98a, 99a, 82a, 96a, 80a, 94a) eine an der genannten Abschlusskappe (24a) gelegene, erste Fläche (98a) und eine an der genannten Abschlusskappe (24a) gelegene, zweite Fläche (99a) aufweisen, wobei die genannte erste Fläche (98a) in einer Ebene gelegen ist, die sich in einem spitzen Winkel zu einer Mittelachse des genannten Ausschnitts (32a) erstreckt, wobei die genannten Flächen (98a, 99a) an einer ersten Stelle auf der genannten Abschlusskappe (24a), die benachbart zum genannten ersten Ende des genannten Körpers (26a) bei eingekoppelter Position der genannten Abschlusskappe (24a), um eine erste Distanz voneinander beabstandet sind, wobei die genannten ersten und zweiten Flächen (98a, 99a) dieser Abschlusskappe (24a) an einer zweiten Stelle auf der genannten Abschlusskappe (24a), die benachbart zum genannten zweiten Ende des genannten Körpers (26a) bei eingekoppelter Position der genannten Abschlusskappe (24a), um eine zweite, gegenüber der ersten Distanz kleinere Distanz voneinander beabstandet sind, wobei die genannten ersten und zweiten Flächen (98a, 99a) derart erstrekken, dass sie miteinander einen spitzen Winkel einschliessen, und
- dass der genannte Körper (26a) ein Paar von Flanschen (68a, 70a) mit im wesentlichen parallelen Oberflächen (82a, 96a; 80a, 94a) aufweist,
- wobei die genannte erste Fläche (98a) mit oberseitigen Flächen (94a, 96a) am genannten Körper (26a) und die genannte zweite Fläche (99a) mit den genannten Oberflächen (80a, 82a) in Eingriff bringbar sind, um den genannten Körper (26a) festzuhalten, bevor das genannte Klemmorgan (60a) das sich in Längsrichtung erstreckende Element im Ausschnitt (32a) gegen den genannten Körper (26a) klemmt.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, dass das genannte Befestigungselement (28a) ein Haken ist, der sich vom genannten Körper (26a) aus gegenüber der seitlichen Öffnung (40a) erstreckt und der mit der Wirbelsäule in Eingriff bringbar ist, wobei der genannte Haken (28a) einen mit dem genannten Körper (26a) verbundenen Schaftabschnitt (34a) und einen freien Endabschnitt (36a) aufweist, welch letzterer sich vom genannten Schaftabschnitt (34a) aus in Richtung einer Ebene erstreckt, die sich ihrerseits durch das zweite Ende des genannten Körpers (26a) erstreckt, um es dem genannten Haken (28a) zu ermöglichen, mit einem Element der Wirbelsäule in Eingriff zu gelangen, wenn das sich in Längsrichtung erstreckende Element im Ausschnitt (32a) angeordnet ist.

3. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, dass das genannte Klemmorgan (60a) als einzelne Stellschraube ausgebildet ist, die gegenüber der genannten Abschlusskappe (24a) drehbar ist, um das sich in Längsrichtung erstreckende Element und den genannten Körper (26a) zusammenzuspannen, wenn das sich in Längsrichtung erstreckende Element im Ausschnitt (32a) angeordnet ist.

Revendications

1. Dispositif utilisable pour retenir un élément s'étendant longitudinalement en position par rapport à une colonne vertébrale, le dit dispositif comprenant un corps (26a) qui présente un évidement (32a) qui s'étend à travers le corps (26a), le dit évidement (32a) ayant une ouverture latérale (40a), une première ouverture d'extrémité (52a) formée dans une première extrémité du corps (26a) et en intersection avec l'ouverture latérale (40a), et une deuxième ouverture d'extrémité formée dans une deuxième extrémité du corps (26a) à l'opposé de la première extrémité et en intersection avec l'ouverture latérale (40a) pour permettre d'introduire l'élément s'étendant longitudinalement dans l'évidement (32a) à travers l'ouverture latérale (40a) de sorte que le dit élément dépasse aux première et deuxième extrémités du dit corps (26a) à travers

les première (52a) et deuxième ouvertures d'extrémité, le dit corps (26a) incluant une partie de connexion (28a) qui s'étend à partir du dit corps (26a) à l'opposé de l'ouverture latérale (40a) et connectable avec la colonne vertébrale pour relier le dit corps (26a) à la colonne vertébrale, un chapeau d'extrémité (24a) déplaçable entre une position désaccouplée espacée du dit corps (26a), et une position accouplée entourant au moins partiellement le dit corps (26a) et s'étendant en travers de l'ouverture latérale (40a) du dit corps (26a), des moyens de liaison (98a, 99a, 82a, 96a, 80a, 94a) pour relier de façon libérable le dit chapeau d'extrémité (24a) au dit corps (26a) lorsque le dit chapeau d'extrémité (24a) est dans la position accouplée, et un élément de blocage (60a) monté sur le dit chapeau d'extrémité, le dit élément de blocage (60a) étant déplaçable par rapport au dit chapeau d'extrémité (24a),lorsque le dit chapeau d'extrémité (24a) est dans la position accouplée, pour bloquer un élément s'étendant longitudinalement,disposé dans l'évidement (32a),contre le dit corps (26a),
caractérisé en ce que les dits moyens de liaison (98a, 99a, 82a, 96a, 80a, 94a) comprennent une première surface (98a) sur le dit chapeau d'extrémité (24a) et une deuxième surface (99a) sur le dit chapeau d'extrémité (24a), la dite première surface (98a) étant disposée dans un plan qui s'étend suivant un angle aigu par rapport à un axe central du dit évidement (32a), les dites surfaces (98a, 99a) étant mutuellement espacées d'une première distance à un premier endroit sur le dit chapeau d'extrémité (24a),adjacent à la dite première extrémité du dit corps (26a) lorsque le dit chapeau d'extrémité (24a) est dans la position accouplée, les dites première et deuxième surfaces (98a, 99a) sur le dit chapeau d'extrémité (24a) étant mutuellement espacées d'une deuxième distance plus petite que la première distance à un deuxième endroit sur le dit chapeau d'extrémité (24a),adjacent à la dite deuxième extrémité du dit corps (26a) lorsque le dit chapeau d'extrémité (24a) est dans la position accouplée, de sorte que les dites première et deuxième surfaces (98a, 99a) s'étendant suivant un angle aigu l'une par rapport à l'autre, le dit corps (26a) ayant deux collerettes (68a, 70a) à surfaces sensiblement parallèles (82, 96a ; 80a, 94a), la dite première surface (98a) venant en contact avec des surfaces supérieures (94a, 96a) sur le dit corps (26a) et la dite deuxième surface (92a) venant en contact avec les dites surfaces (80a, 82a) pour saisir le dit corps (26a) avant que la dite pièce de blocage (60a) bloque l'élément s'étendant longitudinalement dans l'évidement (32a) contre le dit corps (26a).

2. Dispositif suivant la revendication 1, caractérisé en ce que la dite partie de connexion (28a) est un crochet qui s'étend à partir du dit corps (26a) à l'opposé de l'ouverture latérale (40a) et qui peut venir en prise avec la colonne vertébrale, le dit crochet (28a) ayant une partie de queue (34a) connectée au dit corps (26a) et une partie d'extrémité libre (36a) s'étendant à partir de la dite partie de queue (34a) dans la direction d'un plan passant par la deuxième extrémité du dit corps (26a) pour permettre au dit crochet (28a) de venir en prise avec un élément de la colonne vertébrale lorsque l'élément s'étendant longitudinalement est disposé dans l'évidement (32a).

3. Dispositif suivant la revendication 1, caractérisé en ce que le dit élément de blocage (60a) est une vis de pression unique qu'on peut faire tourner par rapport au dit chapeau d'extrémité (24a) pour bloquer ensemble l'élément s'étendant longitudinalement et le dit corps (26a) lorsque l'élément s'étendant longitudinalement est dans l'évidement (32a).

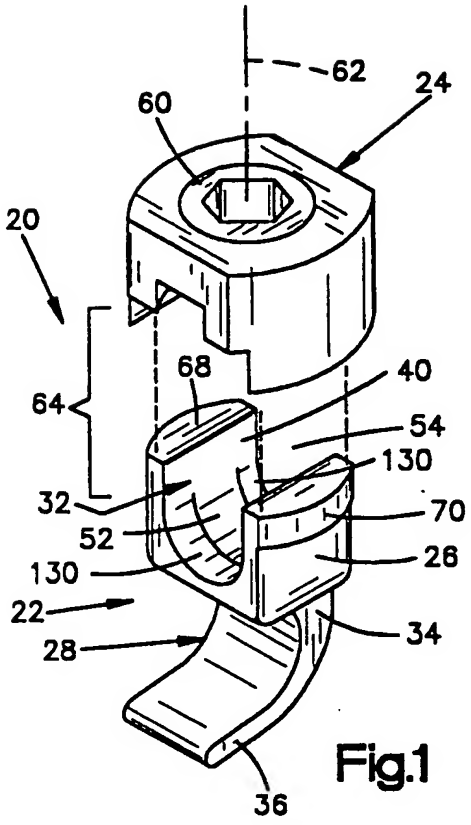

Fig.1

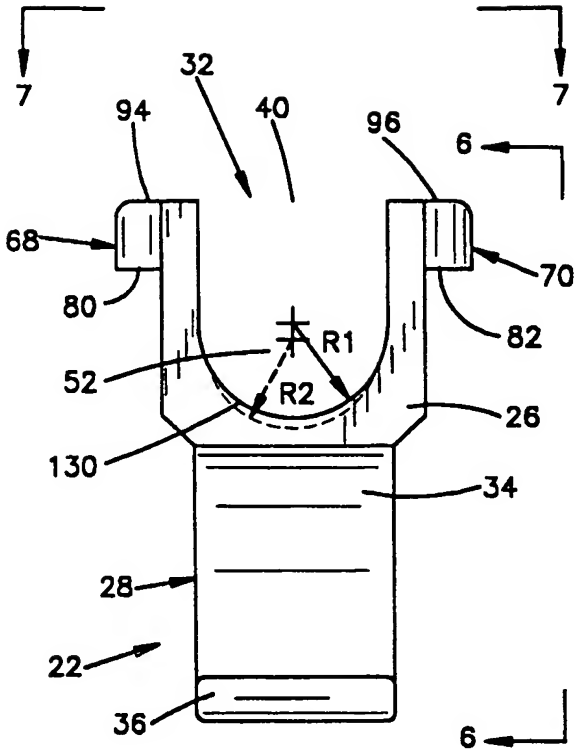

Fig.5

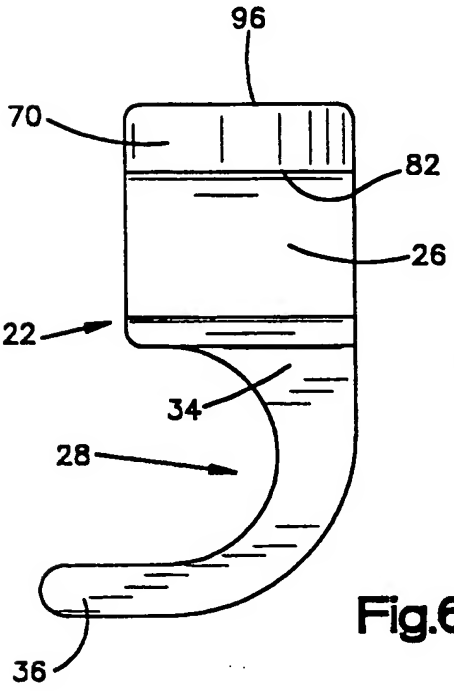

Fig.6

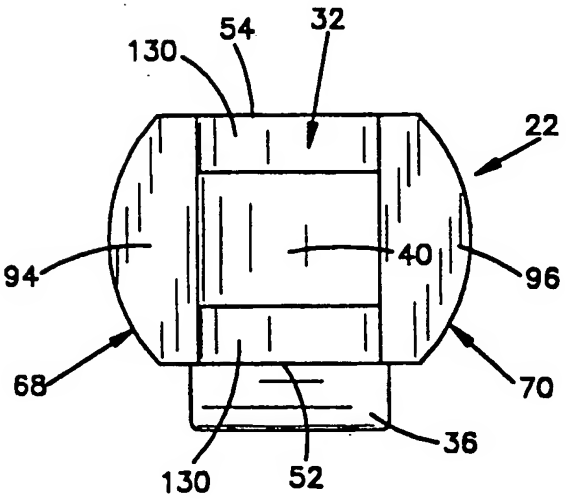

Fig.7

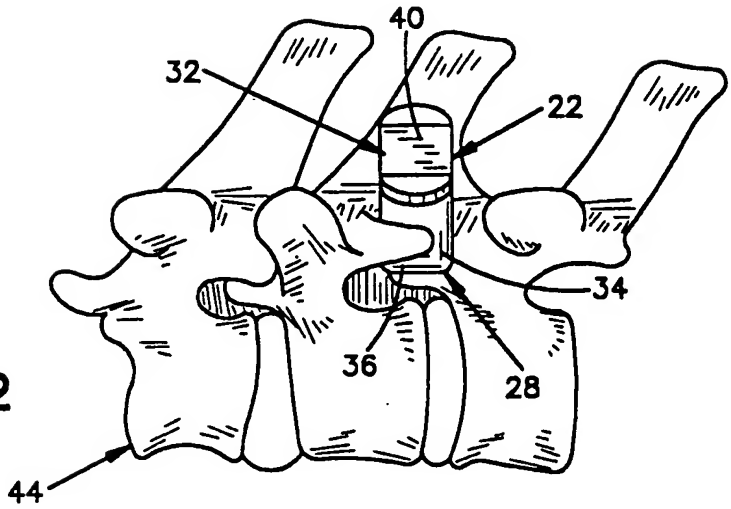

Fig.2

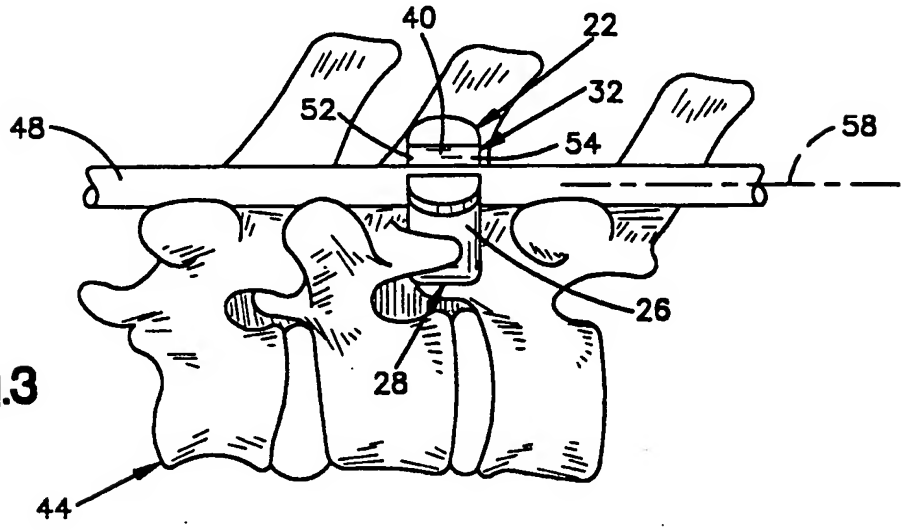

Fig.3

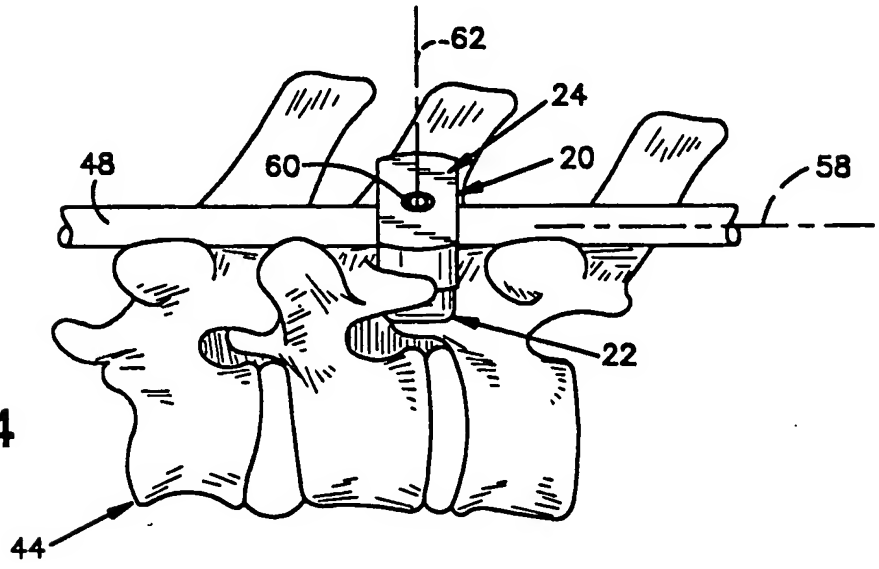

Fig.4

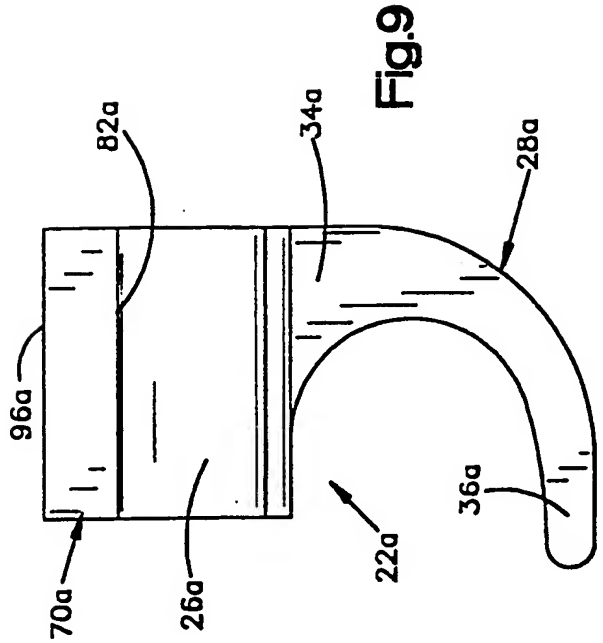

Fig.9

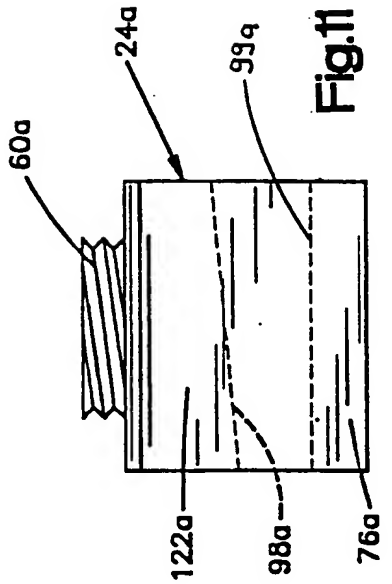

Fig.11

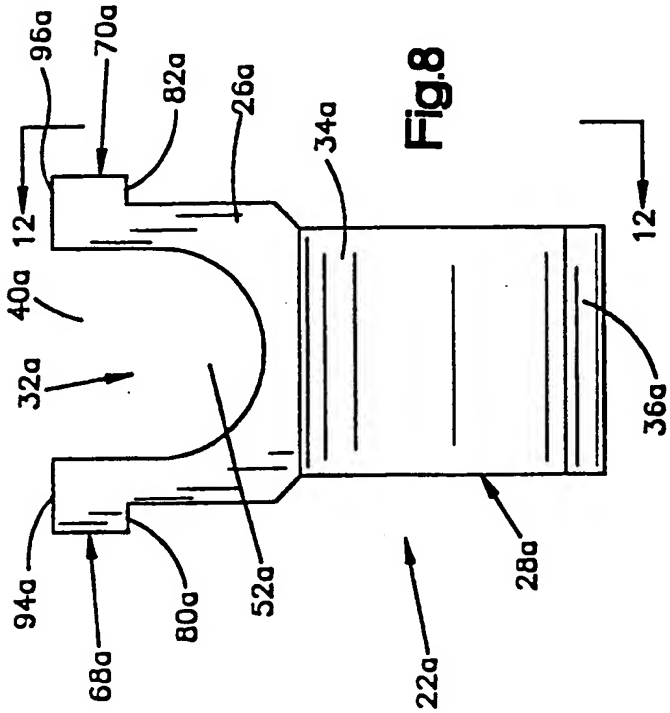

Fig.8

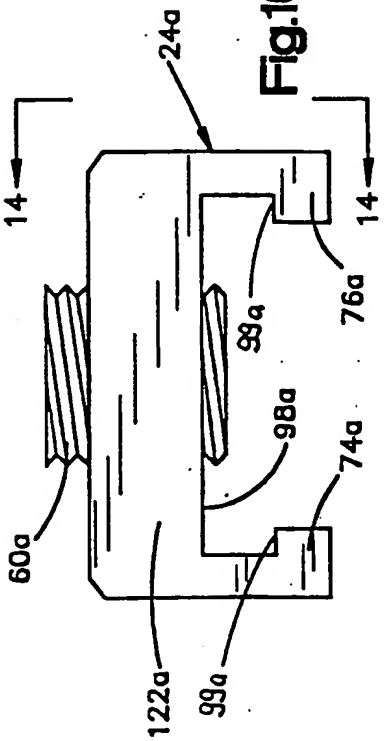

Fig.10